

Closure of Alveolar Cleft by Iliac Bone Grafting: a Case Report

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ABSTRACT:

Introduction: Orofacial clefts are the most common craniofacial birth defects, affecting a significant number of individuals worldwide. The alveolar cleft is a developmental defect that affects the alveolar process of the maxilla and is often associated with cleft lip and palate. **Methods:** In this case report, we present the case of a 20-year-old female patient with alveolar cleft who underwent secondary alveolar cleft reconstruction using autologous iliac bone grafting. The aim of the procedure was to restore the function and form of the maxillary arch, facilitate ridge augmentation for further prosthetic rehabilitation, repair the nasal floor, and facilitate orthodontic treatment. **Results:** The procedure was successful in achieving the desired outcomes, and the patient's occlusal relationship was improved. Additionally, the alar base symmetry was enhanced, and speech was improved. **Conclusion:** Alveolar cleft reconstruction using autologous iliac bone grafting is a successful approach to treating alveolar clefts. The procedure can restore the form and function of the maxillary arch and facilitate further prosthetic rehabilitation and orthodontic treatment. The effectiveness of the procedure should be monitored closely to ensure optimal outcomes.

KEYWORDS : Alveolar Cleft, Autogenous Bone grafting, Iliac Bone grafting

INTRODUCTION:

Cleft lip and palate is one of the most common birth defects in which various environmental and genetics factors play a great role together, leading various syndromic or non syndromic outcomes. The incidence of cleft lip and palate varies depending from ethnic background, geographical and socio economic condition. However 1 per 1000 births is the most globally accepted incidence of cleft lip and palate.¹Men are 2 times more likely to have Cleft lip and palate than woman although women are more likely to have Cleft palate. [2] Alveolar cleft is a maxillary bone defect most commonly occurring between lateral incisors and canine affects 75% cleft lip and palate patients due to in response to divergence from normal development during frontonasal prominence.² Orofacial clefts have a variety of etiological causes, primarily genetic and environmental. Only approximately 10% of cases can be attributed to external variables, such as nutritional deficiencies, hormonal and metabolic disorders, immunological, viral, chemical, and pharmacological impacts, while around 20% of cases can be attributed to genetic causes.^{2,3,4} Orofacial clefts have had a notable impact on quality of life in terms of aesthetics, physical (particularly development and mental) and functional aspects.

Alveolar bone grafting is a surgical procedure that has been accepted for the following reasons: to achieve maxillary arch continuity; to make enough bone available for the eruption of the permanent canine; to maximize alar base reconstruction; to eradicate labial and palatal fistulae; to provide support for the nasal alar cartilage; to stabilize the maxillary segment after orthodontic treatment; to provide enough solid bone before orthognathic surgery; and to provide enough substructure for dental implants.^{5,6} Lexer was the first to report a nonvascular bone transplant, whereas von Eiselsberg developed the use of autologous tissue for alveolar cleft reconstruction. Schmid was

the first to use the technique to implant iliac bone grafts into the bony breach after Drachter reported on the use of the tibial bone to repair an alveolar cleft. Gingivoperiosteoplasty is a boneless bone transplant method introduced by Skoog.⁵ Alveolar grafting procedures are classified into four types based on timing and the age.⁷

- *Primary*—This is performed in a patient below 2 years of age. This is done following lip repair but before the palate is repaired.
- *Early secondary*—Prior to the eruption of the incisors, this is done between the ages of 2 and 5
- *Secondary*—This is done between 8 and 11 years of age, prior to the eruption of the permanent canine.
- *Late secondary*—Performed above 12 years of age, after the canine has erupted.

Prior to the 1970s, the major surgical treatment utilized to correct alveolar clefts was primary bone grafting (PBG) utilizing rib bone during the infancy stage. However, midface retrusion and anterior crossbite have been reported upon long time follow up following PBG. In contrast secondary bone grafting most frequently done during mixed dentition period has been shown to have positive outcome.⁵

Both cortical and cancellous bone can be used for grafting; as maxillary bone is cancellous in nature, so it should be replaced by cancellous bone only for better outcome. Because of the cell transfer and revascularization in osteoinduction and osteoconduction, cancellous bone is seen as being superior choice for bone grafting. Autograft, allograft, xenograft and bone graft substitute are various types of bone graft material which are used for the correction of alveolar graft. The iliac crest or wing, tibia, mandibular symphysis, radius, calvarial bone, proximal humerus, distal ulna, and ribs are some of the sites from which graft tissue can be obtained. However, the iliac crest is known as suitable and called the gold standard for the reconstruction of the alveolar cleft.² The noteworthy advantages of using bone grafts from the iliac crest over other donor sites include ease of access and the availability of a sufficient quantity of both cancellous and cortical bones.^{2,6} A sufficient amount of cancellous bone can be harvested using the trephine technique, which will also minimise the hospitalisation period, the length of the procedure, the intensity of the pain, and the need for painkillers.²

CASE REPORT

A 18 years old female patient was reported to the Oral and maxillofacial surgery department of Update Dental College & Hospital, Dhaka with the complaints of alveolar cleft in upper anterior portion of right side, more specifically in 11-13 region resulting in nasal regurgitation of fluids. One of her main concerns were aesthetic issue due to missing and misaligned teeth resulted from the alveolar cleft. The patient was a known case of Cleft lip and palate which she had got repaired at the age of 3 months and 1 year of age accordingly.

On examination, (Figure-1) patient reveals a concave profile with anteriorly divergent face. Patient has a depressed nasolabial area with increased naso-labial angle. She has a everted and flabby lower lip with short upper lip bearing the scar mark of repaired cleft lip.



Figure 1: Extra Oral Features of the Patient showing concave profile with anteriorly divergent face

Intra-Oral features (Figure-2) include Class III malocclusion according to Angle's Classification along with Anterior cross bite with edge to edge bite on posterior left side and posterior cross bite on right side. Alveolar cleft is present on the 11-13 region with missing upper right central and lateral incisor. Presence of mesiodense, Rotated upper left central incisor and Narrow palate are some of the major findings of intra oral examination.



Figure 2: Intra Oral features showing class III malocclusion with alveolar cleft Orthopantomogram (OPG) (Figure-3) shows radiolucent shadow on right anterior maxillary area which indicates hard tissue defect and a discontinuity from nasal floor upto alveolar crest between right canine and left central incisor. Presence of mesiodense in the defected area. Mesial inclination of left incisors & canine along with right canine & 1st premolar

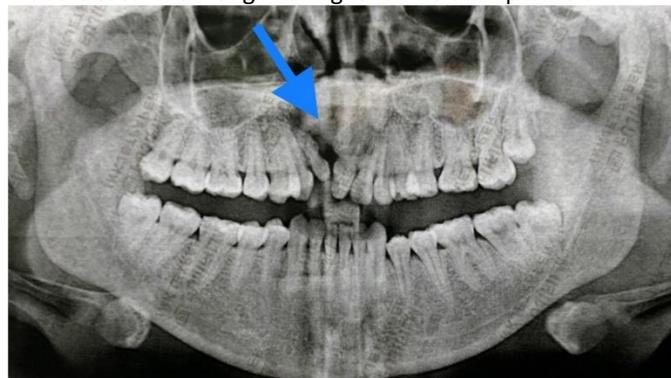


Figure 3 : OPG showing Radiolucent shadow between upper right canine and left central incisor indicating hard tissue defect.

3D view of CBCT (figure-4) scan shows bony defect on alveolar area, on the floor of the nose, anterior mid palate with presence of mesiodense in the defected area.

Axial & Sagittal view of CBCT scan showing hypodensity on the alveolar area, on the floor of the nose and on the anterior mid palate confirming the bony defect. In addition to that, coronal view shows V shaped palate confirming collapsed anterior palate.

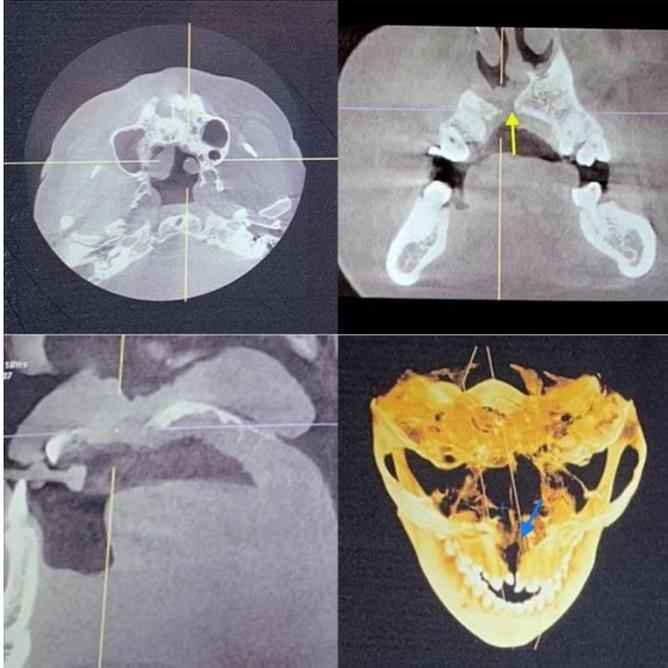


Figure 4 : CBCT scan of Maxillofacial region

Other routine investigations together with a X-ray of a KUB region were done but nothing was found significant.

A provisional diagnosis of alveolar cleft with hard tissue defect of the anterior palate was made with a view to repairing of the alveolar and palatal cleft by Autogenous iliac bone grafting under General Anesthesia.

Under general anesthesia and naso-endotracheal intubation, the patient was appropriately positioned for this surgery. After proper draping and painting, crevicular incision was given from the upper right 1st premolar to left 1st premolar with two vertical releasing incision were given bilaterally from interdental space between first and second premolar upto mucobuccal fold and flap was elevated. To separate the labial/nasal and palatal/nasal mucosa, incisions were made along the cleft edges. Palatal mucoperiosteal flaps were elevated just enough to visualize the cleft. To enable precise approximation, all hypertrophic mucosae (if existent) -sutured together to form a nasal floor at the same level as on the noncleft side with interrupted sutures. In order to provide room for the bone graft, the palatal mucoperiosteal flaps were next approximated medially using interrupted 4-0 absorbable sutures. Assessment of defect area after repairing soft tissue defect of nasal floor, oral and palatal mucosa was done.

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Figure: 5 -reflection of nasal floor and Palatal Mucosa

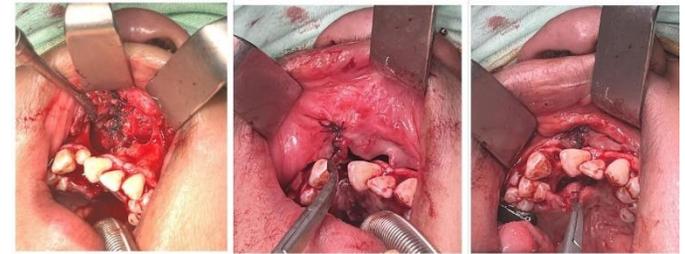


Figure : 6- repair of Nasal Defect ,Oral Mucosa and Palatal Mucosa

After the patient was properly positioned, preparation of donor site with all aseptic precautions by proper draping and painting was done. An incision was made through the skin and periosteum, starting approximately 1.0 cm lateral and inferior to the right anterior iliac spine. The skin was retracted prior to making the incision so that it lay lateral to and beneath the crest instead of over the crest. The superior portion of the incision was then retracted medially and osteotomy on the right iliac crest area to expose the donor site. Collected Cancellous bone from the donor site was placed to the recipient site. Closure of the recipient site followed by closure of the donor site was done layer by layer by securing a drain tube.



Figure:6 – Collecting cancellous bone from Right iliac crest

Website: <https://www.banglajol.info/index.php/UpDCJ>



Figure 7- closure of recipient and donor site after bone grafting

To prevent a superficial hematoma, the wound was covered with a pressure dressing. Ten days' worth of postoperative antibiotics were given as needed. Sutures were taken out ten days after the procedure whereas on the second postoperative day the drain tube was removed. Early ambulation was advised to lessen the amount of discomfort and impairment. Post operative complications were evacuated weekly both on the donor site and recipient site. No sign of infection, hematoma, paresthesia, exposure of the graft, wound dehiscence were noted.

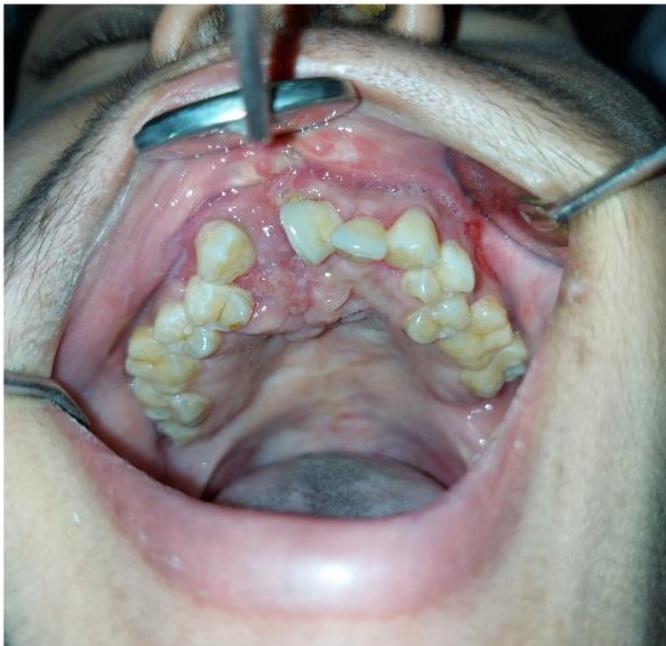


Figure 8 : follow up after 2 months with no sign of infection, hematoma and wound dehiscence

Some rehabilitation planning is considered here such as Orthodontic treatment after 6 months which includes space correction by arch expansion, correction of Class III malocclusion and correction of rotated and inclined teeth. Le fort 1 osteotomy with maxillary advancement is also considered for the correction of skeletal Class III malocclusion.



Figure 9 : Post Operative OPG after 2 months of bone grafting

DISCUSSION

Autogenous bone grafts have traditionally been the treatment of choice for alveolar cleft deformities. To facilitate correct eruption of the dentition in a normal alveolar arch and to facilitate orthodontic teeth movement, the alveolar cleft has to have its bone structure repaired. In the present case, the alveolar grafting was done at 18 years-old in order to correct the nasal defect, to provide proper bone support for prosthetic rehabilitation and to facilitate orthodontic alignment of the teeth. The replacement of a bone fragment from one area of the body to another is done in order to correct a skeletal defect. In reconstructive surgery, a variety of bone grafts are offered. A successful categorization classifies the bone grafts according to their origin and, consequently, their capacity to trigger an immune reaction. Patients with alveolar and palatal clefts are frequently treated with Autogenous Bone grafting. The main goal of this operation is to enhance dental alignment. Repair of the alveolar cleft with bone grafting enables eruption of the canine through the grafted bone or placement of the implants. Alveolar repair should not impede maxillary or midfacial development.^{8,9} Due to its ease of access and the fact that a percutaneous incision makes it simple to obtain enough cancellous bone, the alveolar cleft in this case was repaired using an iliac bone graft. Autogenous cancellous bone graft has four important properties: osteoconductive matrix, that acts as a scaffold or framework into which bone growth occurs; osteoinductive factors (growth factors such as bone morphogenetic protein (BMPs) and transforming growth factor beta (TGF- β) that promote local factors to stimulate bone formation); osteogenic cells (include primitive mesenchymal cells, osteoblasts, and osteocytes) and structural integrity.^{6,10} The success of the bone graft can be assessed by clinical and radiological assessment. Moreover, radiographic evaluation appears to be efficient and superior to clinical techniques. Conventional radiographs (Orthopantomogram, periapical and occlusal) together with CT scan and specialized software are necessary to assess the defect, for determining the amount to be required for grafting as well as evaluation for post-operative bone formation. Using the Bergland scale and

Chelsea scale, the radiological result will be evaluated based on the appearance.¹¹

The concerns associated with iliac bone harvesting is the possibility of effects on growth, hematoma and donor site morbidity. A meticulous surgical procedure with a small incision, removal of the iliac crest's muscle attachment, good hemostasis, careful wound closure, and adequate postoperative pain management can reduce such consequences.¹² Alveolar bone develops quickly from fresh autologous cancellous bone. Under optimum condition, osteogenic cells in autogenous cancellous bone grafts will survive and initiate new bone growth in a few of days. Inflammation (chemotaxis activity stimulated by necrotic debris), osteoblast differentiation from precursors, osteoinduction (osteoblast and osteoclast function activity), osteoconduction (new bone forming over scaffold), and remodeling, which is a long-term process, are the five stages of the continuum of bone graft healing.¹⁰

In addition to Autograft and allograft, bone graft substitutes such as Calcium phosphate graft materials like tricalcium phosphate (-TCP) and hydroxyapatite known as synthetic bone materials which have excellent biocompatibility.¹³ BMP are osteoinductive in nature. When linked with irregular hard tissue defects, the rhBMPs such as BMP-2, BMP-4, and BMP-7, along with the proper carrier, aid in the restoration of missing tissue.¹⁴

CONCLUSION

The techniques for treating alveolar clefts are changing throughout time in order to better serve patients' needs in terms of both function and appearance. The preferred treatment for managing alveolar clefts is secondary alveolar osteoplasty, which is widely approved. Despite conflicting risk and benefit reports, autologous bone grafts are consistently maintained as the gold standard for the restoration of alveolar clefts. In conclusion, the maxillary arch continuity, maxillary segment stabilization following orthodontic treatment, provision of a solid maxillary structure prior to orthognathic surgery, and provision of substructure for dental implant placement or other prosthetic rehabilitation are the main goals of alveolar cleft closure using autogenous iliac crest for secondary grafting.

CONFLICT OF INTEREST:

The authors declares that there is no conflict of interest regarding the publication of this article.

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